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*Published in:*  
Book of Abstracts. DTU's Sustain Conference 2015

*Publication date:*  
2015

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*  
Zhang, L., Hansen, T. W., He, M., Kling, J., Jiang, H., Kauppinen, E. I., & Wagner, J. B. (2015). In situ ETEM Study on the Growth Termination of Single-Wall Carbon Nanotubes. In *Book of Abstracts. DTU's Sustain Conference 2015* [M-9] Technical University of Denmark.

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## ***In situ* ETEM Study on the Growth Termination of Single-Wall Carbon Nanotubes**

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Single-wall carbon nanotubes (SWCNTs) with specific structures are ideal materials in nano-electronics. Taking thin film field effect transistors as an example, semiconducting SWCNTs show more promising performances than traditional indium-containing semiconductors as channel materials. Besides, the latter is a kind of critical materials derived from limited natural resources. Therefore, in a long run, the study on indium replacement by SWCNT thin film with improved performance and reliability is important for both fundamental research and industrial applications. The first step for that is to synthesize SWCNTs with high yield and specific structure. Understanding the growth termination mechanism of SWCNTs is of great importance for maximizing the quality and yield, and for controlling their structure. Generally, it involves the deactivation of catalysts by carbon encapsulation or morphology evolution (Ostwald ripening), and the diffusion-limited supply of carbon feedstock to the catalyst. However, the detailed microscopic causes of tube growth cessation are still lacking. Here we show the direct experimental evidence on the growth and termination of SWCNTs from Co/MgO catalysts using CO as carbon source inside the environmental transmission electron microscope (ETEM) (see [1, 2]). The dissociation of SWCNTs from the catalysts was widely observed. Interestingly, new tubes are able to nucleate and grow from the same particle that is abruptly deactivated for the initial SWCNT, suggesting a high activity of catalysts and a different nucleation and termination process of SWCNTs.

### **Reference**

[1] He, M., et al.; Chiral-Selective Growth of Single-Walled Carbon Nanotubes on Lattice-Mismatched Epitaxial Cobalt Nanoparticles. *Sci. Rep.*, 3, 2013

[2] Hansen, T.W.; J.B. Wagner; Catalysts under Controlled Atmospheres in the Transmission Electron Microscope. *ACS Catal.*, 4, 1673, 2014